

## DIVERSITY OF SPIDERS IN DIFFERENT LOW LYING CROP FIELDS OF SOUTH 24-PARGANAS, WEST BENGAL

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### ABSTRACT

Spider diversity was evaluated in low lying crop field of Ramakrishna Mission Ashrama, Narendrapur. The study was conducted in both organic and inorganic fields of mustard (*Brassica campestris*), french bean (*Phaseolus vulgaris*) and brinjal (*Solanum melongena*). A total of 341 individuals belonging to 19 morphospecies under 14 genera and 7 families were recognized. Recorded spider individuals include 217 from organic field while 124 from inorganic and most being female in every crop. Among the recorded species *Oxyopes shweta* (50) was the most abundant. Brinjal accommodates more number of individuals/species than the rest. Organic farming is found to encourage *Leucauge decorata* and *Pardosa songosa* in mustard while *Oxyopes shweta* and *Leucauge decorata* in french bean and *Neosona theisi* in brinjal. Of these *N. theisi*, *O. shweta* and *Telamonia dimidiata* appear pesticide tolerant. Richness of spider species seems to be governed by the significant interactions between crop type and agronomic practices (organic and inorganic).

**Key Words:** Spider, low lying crop field, mustard, french bean, brinjal, organic, inorganic

### INTRODUCTION

Spider fauna composes an important part of world biodiversity. They play an important role in regulating insect pests in agroecosystems. The spider fauna of several crop ecosystem have been well documented in some parts of the world, e.g. cotton, soybean, alfalfa, maize, citrus orchards, deciduous orchards and rice (Barrion

and Litsinger, 1995; Pearce *et.al.*, 2004; Satpathi, 2004; Ghavami *et. al.*, 2007; Bolu *et. al.*, 2008; Mahalakshmi and Jeyaparvathi, 2014). A desirable biological control agent is a predator that not only reduces pest densities, but also stabilizes them at low levels, while maintaining stable populations itself (Pedigo 2001). Spiders can be effective predators of herbivorous insect pests, and can exert considerable top-down control, often catching more insects than they actually consume. In depth knowledge on the biodiversity of spider communities of agricultural field is important both in terms of enhancing pest control and understanding the driving forces influencing conservation strategies. Globally there are more than 40,700 spider species out of which about 1686 species are known to occur in India (Keswani *et al.*, 2012; Platnick, 2014). In India, studies on the population and abundance of the spider assemblages in agricultural crops are limited. But unfortunately attempt to document the spider fauna of low lying crop fields of South Bengal is still wanting. Present study aims at unveiling the spider biodiversity of agro-ecosystem like mustard, french bean and brinjal of South 24 Parganas, West Bengal.

## MATERIALS AND METHODS

Both inorganic and organic fields of mustard, french bean and brinjal crop ( Fig. 1) in the 'Faculty Centre of Integrated Rural Development, Ramakrishna Mission Ashrama, Narendrapur' ( 22°26' N, 88°41'E), South 24 Parganas , West Bengal were selected for spider sampling.

Spiders were collected from 102 x102 plot identified within each of the crop fields of both inorganic and organic. Four sticks tied with a rope were placed to mark the sampling site. Survey was made in weekly interval during 2<sup>nd</sup> week of January to 2<sup>nd</sup> week of April, 2014.

Collection was made by visual search, hand picking and pitfall traps. Samples thus collected were preserved in 70% alcohol in small vials for taxonomic study (Jonathan & Kulkarni, 1986). Necessary field data viz. location, habitat, date of collection, collector's name and other relevant information were noted in the field note book. Spiders were later permanently stored in vials containing Audman fixative. Shannon-Weiner diversity index of spiders of both organic and inorganic fields were calculated.

## RESULTS

A total of 341 individuals belonging to 19 morphospecies under 14 genera and 7 families are recognized (Fig.1 and Table-1). Recorded spiders include 217 individuals from organic fields while 124 from inorganic (Fig.2), most being females (88.56%) (Fig.3). Among spider species *Oxyopes shweta* (50) is the most abundant, followed by *Neoscona theisi* (46), *Leucauge decorata* (45) and *Pardosa birmanica* (40) and they are the dominant members. Brinjal accommodates more no. of

**Table -1 : Morphospecies recorded from different low lying crop fields of south 24-parganas, West Bengal**

<b>Family</b>	<b>Genus</b>	<b>Species</b>	<b>Total no. of Individuals</b>	<b>Male morph</b>	<b>Female morph</b>
1. AraneidaeCl erk	1. <i>Cyclosa</i> Menge	1. sp.	1	0	1
	2. <i>Cyrtophora</i> Simon	2. <i>cicatrosa</i> (Stoliczka)	3	1	2
	3. <i>Larinia</i> Simon	3. sp.	2	0	2
	4. <i>Neoscona</i> Simon	4. <i>theisi</i> Walckenaer	46	5	41
	5. <i>Lycosa</i> Latreille	5. <i>phipsoni</i> Pocock	7	1	6
2. Lycosidae Sundevall		6. <i>tista</i> Tikader	15	2	13
	6. <i>Pardosa</i> C. L. Koch	7. <i>birmanica</i> Simon	40	4	36
		8. <i>pseudoannulata</i> (Bösenberg & Strand)	11	0	11
3. Oxyopidae Thorell		9. <i>songosa</i> Tikader & Malhotra	35	2	33
	7. <i>Oxyopes</i> Latreille	10. <i>kamala</i> Tikader	22	4	18
		11. <i>shweta</i> Tikader	50	8	42
4. Salticidae Blackwall	8. <i>Bianor</i> Peckham & Peckham	12. sp.	9	0	9
	9. <i>Marpissa</i> C. L. Koch	13. sp.	4	0	4
	10. <i>Telamonia</i> Thorell	14. <i>dimidiata</i> Simon	25	1	24
5. Tetragnathidae Menge	11. <i>Leucauge</i> White	15. <i>decorata</i> (Blackwall)	45	6	39

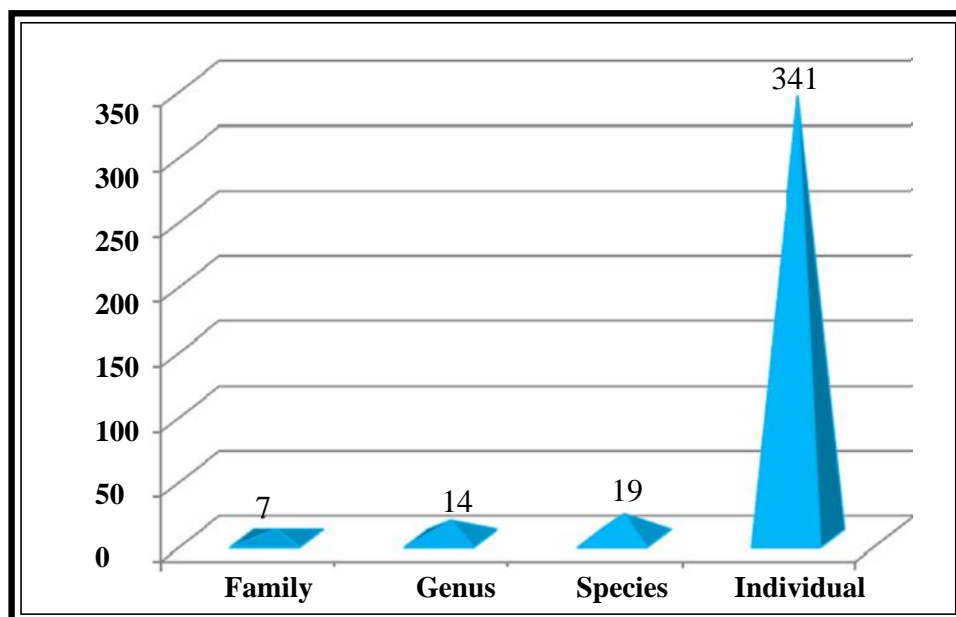
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**Table -1 : Morphospecies recorded from different low lying crop fields of south 24-parganas, West Bengal**

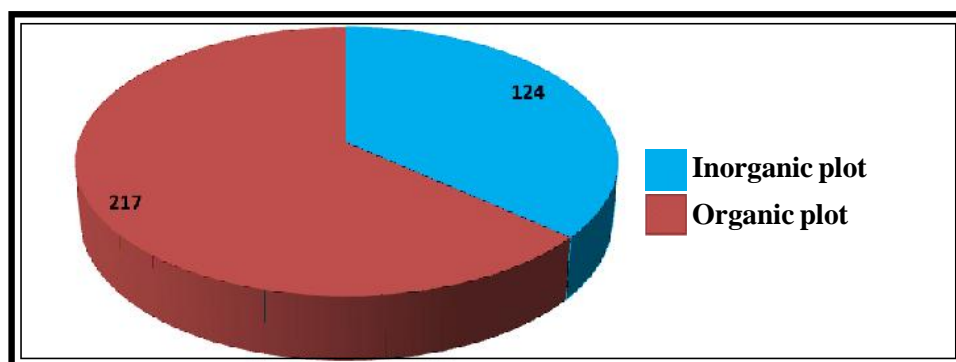
Family	Genus	Species	Total no. of Individuals	Male morph	Female morph
6.Theridiidae Sundevall	12. <i>Tetragnatha</i> Latreille	16. <i>javana</i> (Thorell)	11	2	9
		17. <i>ceylonica</i> Cambridge	11	3	9
	13. <i>Theridion</i> Walckenaer	18. sp.	1	0	1
7.Thomisidae Sundevall	14. <i>Camarius</i> Thorell	19. sp.	3	0	3
Total = 7	14	19	341	39	302

**Table -2: Comparison of Shannon-Weiner diversity index of spiders in organic/inorganic plots of Mustard, French bean and Brinjal crop fields**

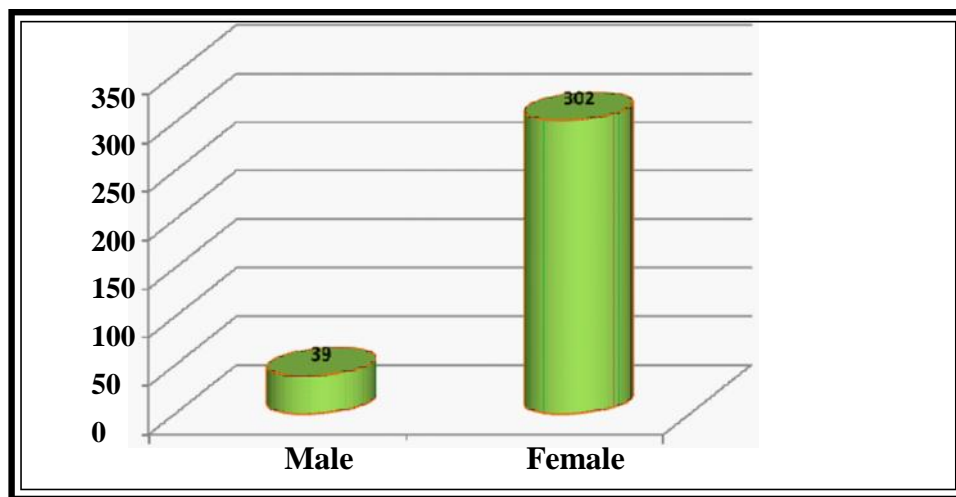
Crop	Organic	Inorganic
Mustard	2.886	2.235
French bean	3.437	2.975
Brinjal	3.267	2.326



**Fig. 1: Total no. of spider taxa and individuals trapped**



**Fig.-2: Distribution of spider individuals in inorganic and organic plots**



**Fig.-3: Proportion of male and female spider individuals sampled**

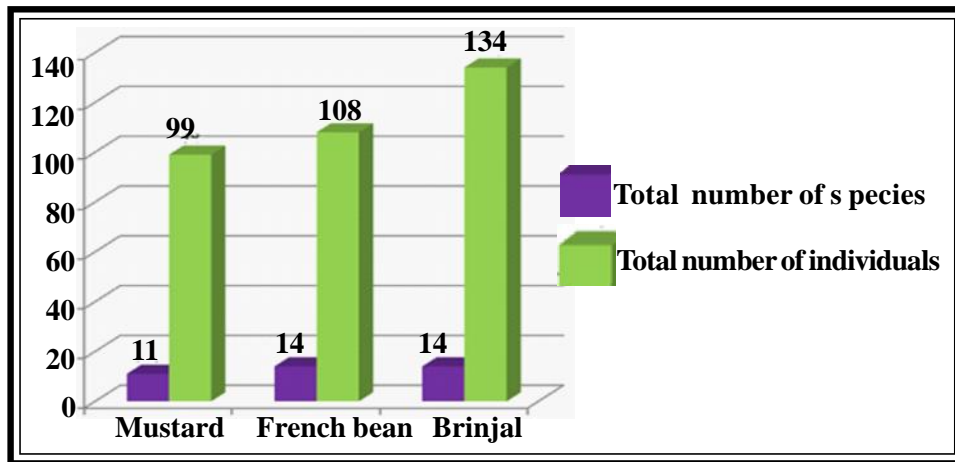


Fig.- 4: Comparison of spider species and individuals trapped from Mustard, French bean and Brinjal crop fields

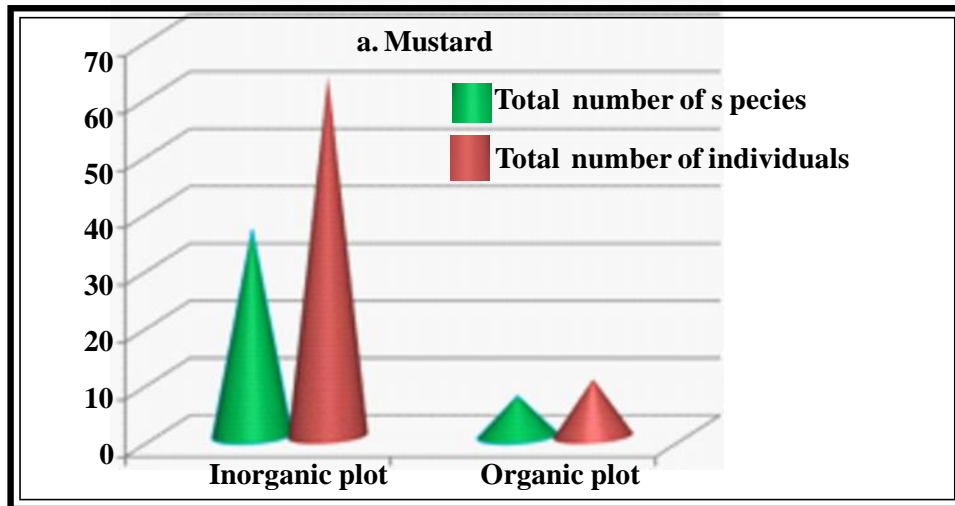


Fig.5a.: Total no. of spider species & individuals trapped from Mustard crop field

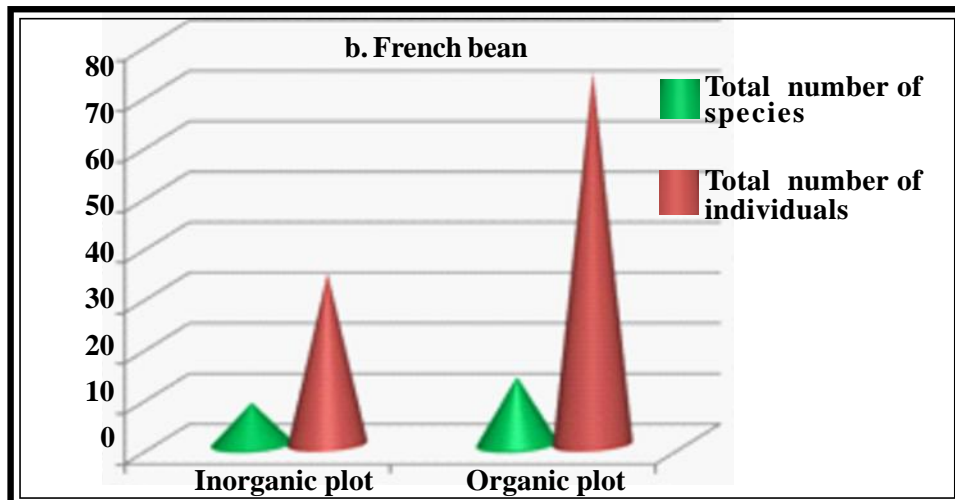


Fig. 5b. : Total no. of spider species and individuals trapped from French crop field

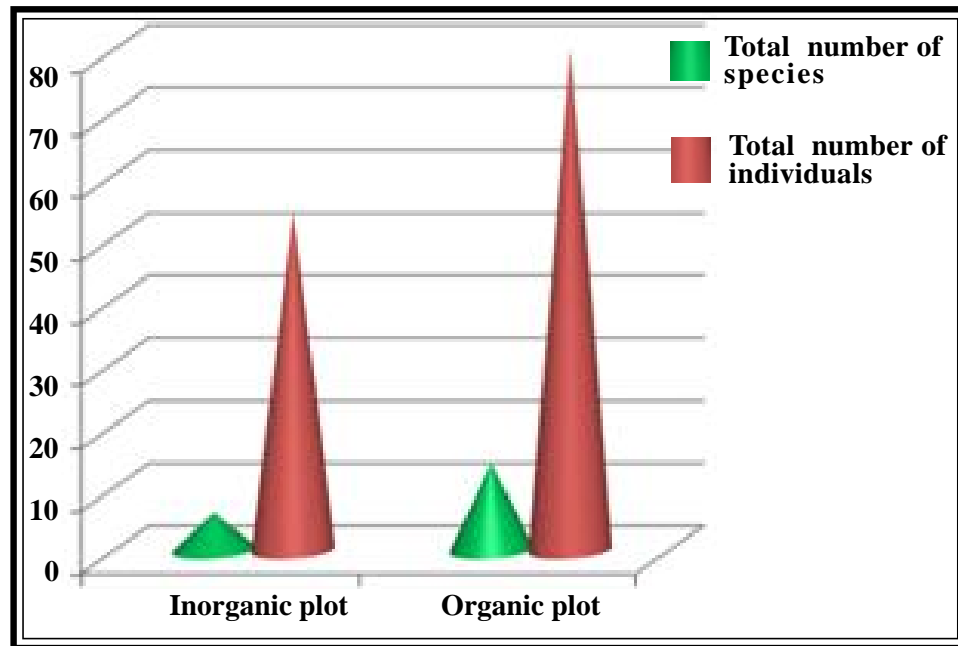


Fig.5c: Total no. of spider species and individuals trapped from Brinjal crop field

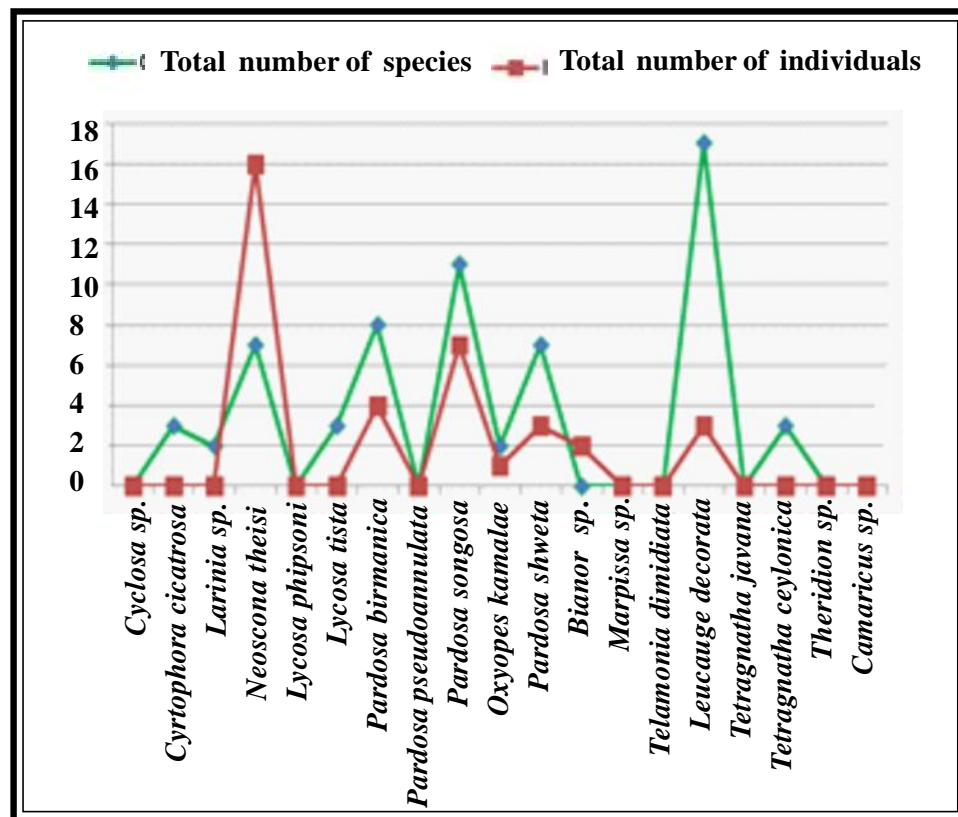


Fig. 6a. Total no. of individuals of the spider species recorded from Mustard crop field

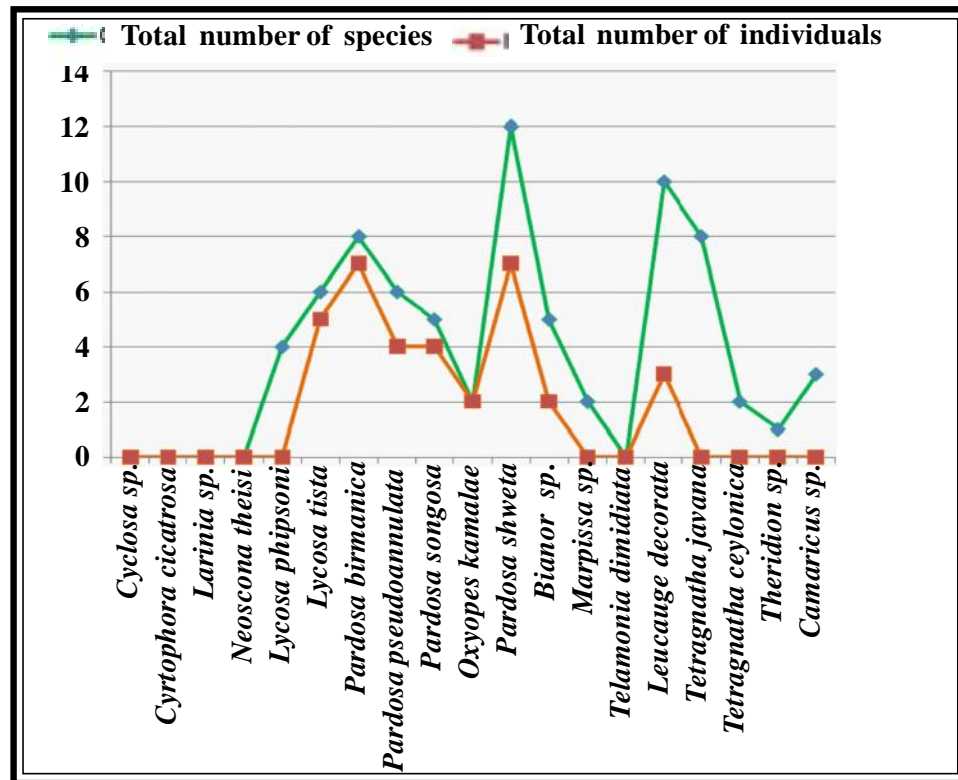


Fig. 6b. Total no. of individuals of the spider species recorded from French bean crop field

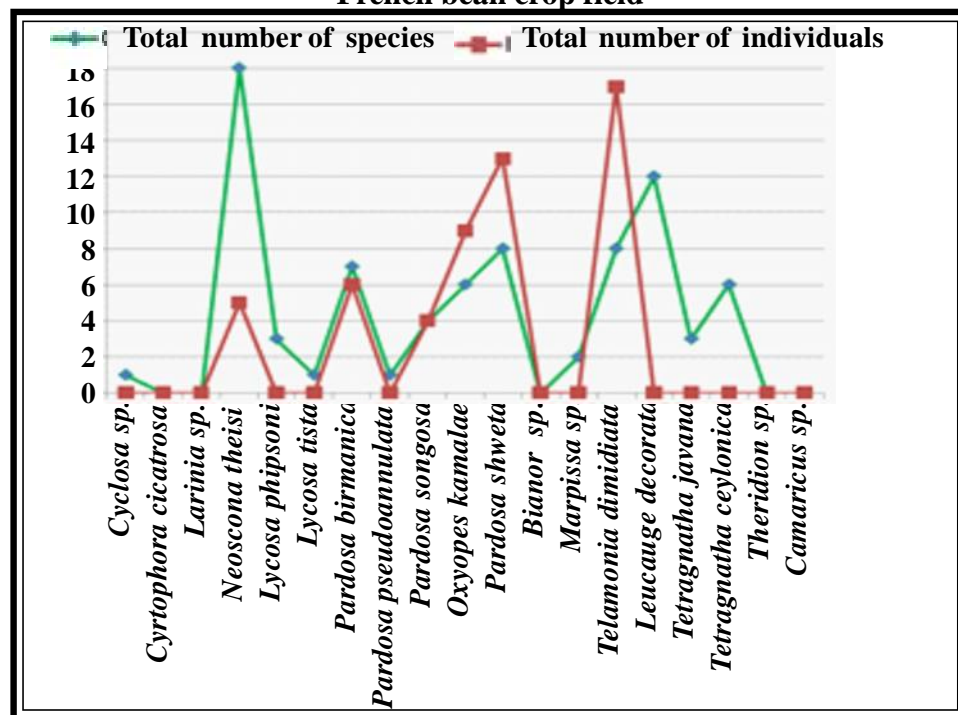


Fig. 6c. Total no. of individuals of the spider species recorded from Brinjal rop field

individuals / species rather than mustard and french bean (Fig.4). Organic farming favours more of predatory components (spiders) both in terms of individuals and species in every crop field (Fig.5a,b,c). Seven spider species are recorded from mustard crop receiving inorganic application while in organic plot it is 10; in french bean, plot with inorganic application accommodates a total 8 species whereas in organic it is 14; in brinjal it is 6 and 14 in plots experiencing inorganic and organic applications respectively. Shannon-Weiner diversity index of spiders in all the organic plots of the three crop fields are higher than the inorganic ones (Table-2). Both abundance and richness of spiders are discrete among fields. Organic farming is found to encourage *Leucauge decorata* and *Pardosa songosa* in mustard while *Oxyopes shweta* and *Leucauge decorata* in french bean and *Neosona theisi* in brinjal. Of these *N. theisi*, *O. shweta* and *Telamonia dimidiata* appear pesticide tolerant (Fig.6a,b,c). Richness of spider species seems to be governed by the significant interactions between crop type and agronomic practices (organic and inorganic).

Out of the 19 species, above referred species appear potential candidates for biological control programme.

## DISCUSSION

Spiders do not consume only pestiferous herbivores. Being generalists, they feed on more than one trophic level in a food web (Morin, 1999). Although model food webs predict that polyphagy will lead to instability, studies of natural communities show that food chains containing generalists are more stable (Wise *et al.*, 1999). Despite the potential to create stable predator populations, polyphagy may be a disadvantage in systems such as agricultural fields, where food chains may be short and simple, consisting of three levels : producer, herbivore and primary predator/parasite. The herbivore is not only limited by competition but by predation/parasitisation. Some of the spiders may be more sensitive to insecticides while others are tolerant. Yardim and Edwards, 1998 opined that spiders are less affected by fungicides and herbicides than by insecticides. Spiders such as the wolf spider *Pardosa* are highly tolerant to botanical insecticides such as neem-based chemicals (Theiling and Croft, 1988; Markandeya and Divakar, 1999). They are also generally more tolerant of organophosphates and carbamates than of pyrethroids, organochlorines, and various acaricides. Tolerance may be due to genetic resistance bred over a period of continuous exposure (Theiling and Croft, 1988; Wisniewska and Prokopy, 1997; Yardim and Edwards, 1998; Marc *et al.*, 1999; Tanaka *et al.*, 2000). For example, *Pardosa*, *Tetragnatha*, are highly sensitive to the inorganic chemicals, but not to botanical pesticide (Tanaka *et al.*, 2000).

In summary, spiders can be effective predators of herbivorous insect pests and can exert considerable top-down control, often catching more insects than they actually consume. Despite the potential for competition and intra guild predation, a diverse assemblage of spiders may have the greatest potential for keeping pest

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densities at low levels. To conserve and enhance spider populations, agricultural systems should be manipulated in ways beneficial to the needs of the spiders. The structural complexity of the environment is directly related to spider density and diversity. Highly varied habitats provide a greater array of microhabitats, microclimatic features, alternative food sources, retreat sites, and web attachment sites, all of which encourage colonization and establishment of spiders (Riechert and Lockley, 1984; Agnew and Smith, 1989; Young and Edwards, 1990; Rypstra *et al.*, 1999).

#### ACKNOWLEDGEMENTS

We express our deep sense of gratitude to Swami Atmapriyananda, Vice Chancellor, Ramakrishna Mission Vivekananda University (RKMVU) for giving us the opportunity to undertake this dissertation work. Thanks are also due to Dr. Manas Ghose Dean and all other staff members, IRDM Faculty Centre, Narendrapur for necessary support.

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